

Physics-based MDAO tool for CMC blades and vanes conceptual design, Phase I

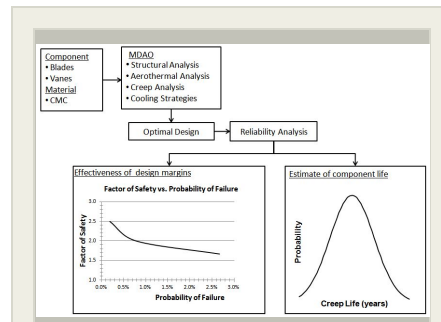
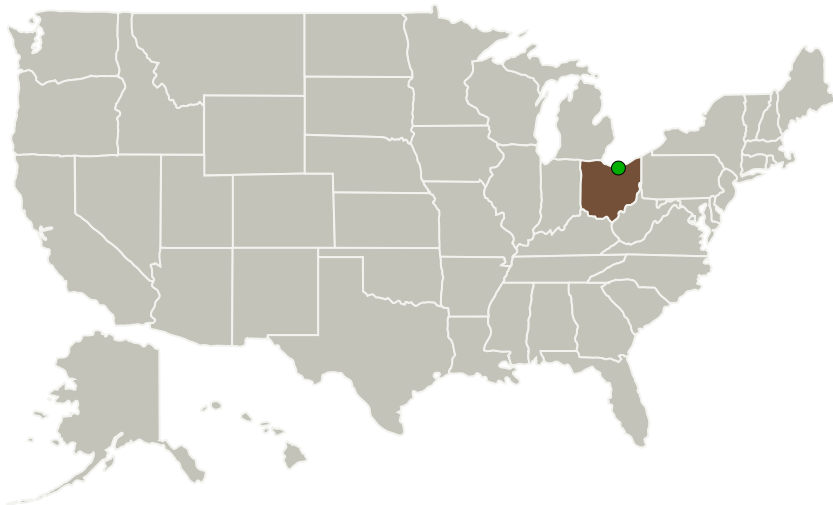
Completed Technology Project (2015 - 2015)



Project Introduction

The proposed work will develop a reliability analysis tool consistent with conceptual-level design for ceramic matrix composite (CMC) turbine blades and vanes. The analysis software will comprise a suite of physics-based discipline specific analysis code modules and NASA's Fast Probability Integrator (FPI). The objective of this analysis tool is to develop optimal material properties, internal and external geometries for a cooled vane/blade using aerothermal, and structural (including creep) analyses. Structural constraints in the form of allowable mechanical/thermal stresses and material constraints in the form of minimum wall thickness and minimum bend radius will be applied. The structural stress analysis will be augmented with a creep module to determine an estimate for part life. The suggested benchmark system problem is a multi-disciplinary analysis of a NASA C3X turbine vane, 2 or 3D versions of the discipline specific models will be taken from the open literature and implemented as plug-in modules for NASA's Open MDAO framework. It is not the intention of this program to develop new MDAO architectures, rather the optimization drivers built into Open MDAO will be used.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
N&R Engineering	Lead Organization	Industry Small Disadvantaged Business (SDB)	Parma Heights, Ohio
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

Project Transitions

**June 2015:** Project Start**December 2015:** Closed out**Closeout Summary:** Physics-based MDAO tool for CMC blades and vanes conceptual design, Phase I Project Image**Closeout Documentation:**

- Final Summary Chart Image(<https://techport.nasa.gov/file/139334>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

N&R Engineering

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

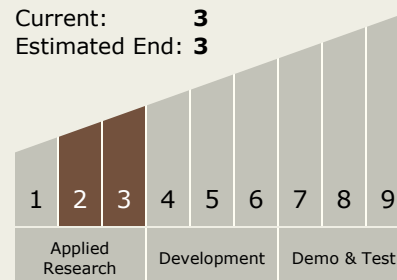
Carlos Torrez

Principal Investigator:

Ian T Miller

Technology Maturity (TRL)

Start: 2
 Current: 3
 Estimated End: 3

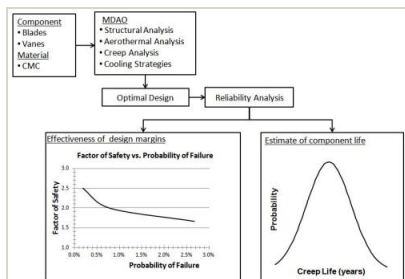


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Images



Briefing Chart Image

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(<https://techport.nasa.gov/image/132492>)

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.2 Modeling
 - └ TX11.2.2 Integrated Hardware and Software Modeling

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System